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POLYGONUM HYDROPIPER IN EUROPE AND NORTH AMERICA.

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Polygonum Hydro Piper L. is a characteristic and well-marked European species which is also somewhat widespread in North America. Recent American floristic works give the impression that it is indigenous in some portions at least of its American range. The discovery of a rather well-marked variety, described later in this paper, which is characteristic of a considerable portion of the American range of *P. Hydro piper*, lends a certain interest to the nativity of the American plant and justifies some discussion of the records of *P. Hydro piper* in America.

The "*P. Hydro piper*" of early writers is strongly suggestive of *P. punctatum* Elliott (*P. acre* HBK.).¹ *P. punctatum* resembles *P.*

¹ American botanists have not been in full agreement as to the name to be used for this species, but *P. punctatum* Elliott and *P. acre* HBK. are usually considered synonymous. The dates of publication are very close, and the records of that time are not all that might be desired. Most of the early North American works used the name of Elliott, probably largely because they were more certain of the identity of his plant than of the one described by Kunth from "prope Havanam et Caracas." Also, in the earlier days the question of priority had not assumed its present importance. The first volume of the more common two-volume edition of Elliott's "Sketch" bears the date of 1821; it was, however, issued in a previous edition serially during 1816 and 1817. This edition is very rare. Part V, bearing the treatment of the Polygonums, as preserved in the Library of the Gray Herbarium, bears the date 1817. Barnhart (Bull. Torr. Bot. Cl. xxviii. 680-688) has investigated the date of its publication and places it as probably December, 1817. The present writer has made inquiry of the Library of Congress and is informed that the South Carolina records concerned were probably destroyed during the Civil War. Under the circumstances there seems no prospect of fixing the date more exactly.

Vol. II of the folio edition of the "Nova Genera et Species" of Humboldt, Bonpland and Kunth is also dated 1817. This also appeared serially, and according to the researches of Barnhart (Bull. Torr. Bot. Cl. xxix. 585-598) the portion treating of Polygonum (ii. pp. 177-180) came out in February, 1818. Under the circumstances Elliott's name seems preferable, and will here be used, except when *P. acre* is used in a quotational sense.

Hydropiper in the bright green cast of its foliage, in its somewhat interrupted and uncrowded panicle, and particularly in the evident development of internal glands (never glandular hairs) and strong peppery flavor. Among the principal differences between the two are the rugosity and dull lustre of the often lenticular achene of *P. Hydropiper* as contrasted with the smooth shining surface of the normally trigonal fruit of *P. punctatum*. Detailed descriptions of the achenes of these plants, however, are hardly to be found in the observations of early American floristic writers. *P. punctatum*, however, has normally eight stamens and a five-parted white or whitish calyx, while *P. Hydropiper* usually possesses only six stamens and a rather herbaceous calyx which is most often four-parted. The earlier writers, following the Linnean system, were usually careful to enumerate the stamens, and in evaluating their descriptions more weight may be laid on this particular than on some others which might more quickly engage the attention of present-day systematists.

It might be noted in passing, that the examination of a considerable amount of material designated by various collectors as "*Polygonum Hydropiper*" and deposited in the Gray Herbarium indicates that the habit-similarities of these two technically well-defined species still cause a great deal of confusion among American collectors. Appearance of reduced panicles within the ocreae of *P. Hydropiper*, with a resultant rather bulged appearance of the short stipular sheath of this plant, contrasts strongly with the close-cylindric effect of the longer sheaths of *P. punctatum*. This character, not generally noted in the floras, was apparently first made known by Meehan.¹ This writer, oddly enough, published the phenomenon as a differential character occurring in *P. acre* HBK., rather than in *P. Hydropiper*; his error in identification was noted by Small in 1895.

The strong acrid pungency of *P. Hydropiper* attracted the attention of physicians of previous centuries, who employed it as a diuretic, as a blistering agent, and for various other purposes. Thus it is not surprising that the first references to what was taken for this plant in America are to be found in medical writings. Cutler, in 1785, employed the Linnean description of *P. Hydropiper*, but not the binomial, with the descriptive comment:

"Blossoms white. Common both in dry and moist land. August. It occasions severe smarting when rubbed on the flesh. . . . It

¹ Meehan. *On a special form of Cleistogamy in Polygonum acre*. Proc. Acad. Nat. Sci. Phila. 1892. 163-164.

dyes wool yellow. Dr. *Withering* says, it cures little apthous ulcers in the mouth.—That the ashes mixed with soft soap is a nostrum, in a few hands, for dissolving the stone in the bladder; but perhaps not preferable to other caustic preparations of the vegetable alkali.”¹

And the German, *Schöpf*² uses the Linnean binomial, giving:

“LOC. Noveboraci subhumida.”

and:

“vsvs: Calculus! Odontalgia, Excoriatura oris.”

The text of neither of these writers is sufficiently explicit to exclude *P. punctatum*. The “white flowers” of Cutler are rather suggestive of that species. Cutler, apparently, never traveled abroad, but *Schöpf*, very probably, may have been familiar with the European plant.

Perhaps it is worth noting that *P. Hydropiper*, which of recent years has been forgotten by the medical profession, seems, judging from two recent papers, to have newly attracted attention in Russia as a hemostatic. Certainly there is need for something of this sort in Russia, and *P. Hydropiper* seems naturally well suited to the Bolshevik taste.

Among the systematists, Michaux seems first to have listed *P. Hydropiper* in America:

“*P. stipulis laxis, glabris, apice ciliatis, maculatis: foliis lanceolatis, omisso margine glabris: spicis filiformibus, debilibus, subcernuis; bracteis remotiuscule alternis; floribus albidis, octandris, semitrigynis. Obs. Sapor, herba, florescentia Hydropiperis europaei. Flores semel vidi 7-andros, nunquam vero stamina pauciora.*

Hab. in Pennsylvania, Kentucky, regione Illinoensi et Carolinis.”³

Small, in 1895, accepted this description as referring without doubt to the Linnean *P. Hydropiper*; but whatever Michaux’s personal knowledge of the European species described by Linnaeus (1753), the characters of the androecium and the white flowers engender a strong suspicion that Michaux’s plant is the same that was later to be described by Elliott as *P. punctatum*.

Next, chronologically, comes the rather cryptic “Catalogus” of Mühlenberg (1813). The flowers of “*P. Hydropiper*” here are “alb.-pur.” A purpurascence sometimes appears on the calyx-tip of *P. Hydropiper*, but the prevailing hue of the flower is greenish.

¹ Cutler, *An Account of Some of the Vegetable Productions naturally growing in this Part of America, botanically arranged*. Mem. Am. Acad. i. 439 (1785).

² *Schöpf*, *Materia Medica Americana potissimum Regni Vegetabilis* (1787). Reprinted as Bull. Lloyd Libr. no. 6. Reprod. Ser. no. 3 (1903).

³ Michx. Fl. Bor.-Am. i. 238 (1803).

Pursh (1814), who referred *P. hydropiperoides* Michx. to *P. mite* Pers., described a "*P. Hydropiperoides*" of his own: "*P. floribus 8-andris semi-3-gynis . . . Michx. fl. amer. 1. p. 228. sub. P. Hydropiperide . . . Flowers white; taste and appearance of P. Hydropiper, but different in the flowers.*" Here, again, the white flowers, 8 stamens and 3 styles at once suggest *P. punctatum*. Elliott (1817) proposed *P. punctatum*, which is described in fair detail and is generally considered synonymous with *P. acre* HBK. which was published at almost the same time. Elliott cites both *P. hydropiperoides* Pursh and *P. Hydropiper* Michx. as synonyms, and the same citation is given by such closely contemporary writers as Barton (1818), Darlington (1826) and Beck (1833), who do not list *P. Hydropiper*.

The first American description which appears really to fit the Linnean plant is that of Bigelow (1814):

"Stamens six; styles two, half united; leaves lanceolate, spotless, waved; spike filiform, nodding; stem erect. *Sm.*

Well known for its intense acrimony. . . . Stipules loose, glabrous, fringed with hairs at the top . . . Michaux observed eight, and never less than seven stamens in this plant in America

. . . .¹
 "*Sm.*," carried back to Smith (1800) brings to light a Latin description from which that of Bigelow is a translation, and which was obviously drawn from English material. But Bigelow's second edition (1824) includes as synonyms *P. hydropiperoides* Pursh and *P. punctatum* Ell. The identity of Bigelow's plant, then, is rather problematical. If the description be taken at its face value it is apparently the oldest American description of true *P. Hydropiper*, but the citation of the synonyms indicates that Bigelow did not clearly understand the species.

The three editions of Darlington give some ground for the suspicion that the "*P. punctatum* Ell." of some of these early writers may really have been *P. Hydropiper*. In the first edition of the "*Florula Cestrica*" (1826: p. 48) the description of "*P. punctatum*" is brief, and might apply to either plant; but the notation of habitat suggests *P. Hydropiper*: "Barnyards, lanes, along ditches, &c. common."

In the second edition (1837: p. 248) the wording is much amplified:

" . . . styles 2, or 3; seed lenticular, or triquetrous . . .
Flowers articulated to pedicels about as long as the perianth . . .

¹ Bigel. Fl. Bost. 93 (1814).

Perianth green, covered with brownish glandular dots, the margins of the segments white, often tinged with purple . . . *Seed* compressed, ovate and lenticular, or ovoid-triangular . . . purplish black when mature, roughish punctate under a lens. *Hab.* Moist waste grounds; margins of pools & ditches: frequent . . . *Obs.* The *seeds* of this species are generally compressed, with 2 styles; but often on the same plant they are triangular . . .”

All of which is suggestive of *P. Hydropiper* and not of *P. punctatum*; furthermore, the flowers on pedicels about equaling the perianth and the compressed, ovate and lenticular (not flattened) fruit are characters of the American variety of the plant rather than of the European type. *P. Hydropiper* Michx. is included in the synonymy, with the statement “not? of L.”

Darlington's third edition (1853: p. 247) elucidates the matter:

“*P. Hydropiper* L. . . . *P. punctatum*. *Fl. Cestr. ed. 2, p. 248*, not of Ell. (*fide* ENGELMANN) . . . *Hab.* Moist waste grounds; introduced? . . . *Obs.* I have a suspicion that this is but a *naturalized* weed, among us. It would seem to be distinct from the *P. punctatum* of ELLIOTT,—with which I have hitherto confounded it. Dr. ENGELMANN, writing to me, in October, 1847, says—*Polygonum Hydropiper* and *P. punctatum* are two well-distinguished species; known from a distance already by the heavy pendulous green spikes of the former, and the light more distant-flowered erect whitish spikes of the latter; this has, also, amongst other distinguishing characters, shining smooth nuts,—the other opaque rough ones, &c. Both grow here [*St. Louis, Missouri*] common.”

Though Darlington does not cite his first edition (1826) he no longer lists *P. punctatum* Ell. Therefore it is fairly apparent that *P. Hydropiper* was common in Chester County, Pennsylvania, as long ago as 1826, and (judging also by more recent references in which the two are confounded) it may well be conjectured that Darlington may not have been the only writer of that day to describe *P. punctatum* from *P. Hydropiper*. Engelmann's German botanical experience, coupled with his well-known powers of observation, accounts for his clear differentiation of these two species whose similarities had proved so deceitful.

Widespread occurrence in 1826, of course, does not necessarily mark the plant as native. *P. Persicaria* (a much more aggressive weed, however) was described from Virginia by Gronovius (1739) and is generally and probably correctly listed as an introduction.

The first edition of Gray's Manual (1848: p. 387) describes “**P.**

Hydropiper, L. . . . *leaves lanceolate . . . wavy margined; sheaths inflated . . . fruit either lenticular or 3-sided . . . roughish . . .* (P. *Hydropiperoides*, Pursh. P. *punctatum*, Ell.)
 Low grounds, very common . . . A well-known, intensely acrid plant." The second edition (1856: p. 373) separates *P. Hydropiper* and *P. acre* HBK. (*P. punctatum* Ell.) with the comment on the former "(Nat. from Eu.)" In the fifth edition (1867: p. 416) is the remark as to *P. Hydropiper*: "apparently introduced eastward, but indigenous northward." Small, in 1895, amplified this somewhat: "Naturalized from Europe southward and eastward, said to be native in the north and west"; and this is virtually the statement carried in the seventh edition of Gray's Manual (1908).

Britton & Brown (1896) take another view: "Naturalized from Europe in our area, perhaps indigenous in the far Northwest," and this statement was also continued by Britton in 1901. Turning, therefore, to records primarily concerning other sections of the country, Walter (1788) and Elliott (1817) list from the South nothing suggestive of *P. Hydropiper*. It is also missing from the three editions of Darby's Southern Botany. Chapman (1860) does not contain it, but his second edition (1883) lists it as "Common Smartweed . . . Roadsides, Northern Georgia, and northward," without comment on its origin there. Among southwestern and western records, Porter cited "*P. Hydropiper*" as occurring at "Samoita Valley, Arizona, at 4,500 feet elevation . . . Rothrock (688). Introduced?"¹ But Rothrock's no. 688, as represented in the Gray Herbarium, is typical *P. punctatum* Ell. Watson in 1880, included *P. Hydropiper* as "A European species which also ranges across this continent northward; found in Washington Territory and perhaps in Northern California."² Coulter said "Ranging across the continent northward where it is probably indigenous."³ Rydberg in 1917 said "nat. from Eu."⁴ Howell (1902) and Piper (1906) list *P. Hydropiper* from the Northwest, but offer no speculations as to how it got there,

Central and eastern Canadian records are scanty. Provancher (1862) lists a plant as: "*P. Hydropiper* Michx.—*P. punctatum* Ell. . . . Calice de même que le tige chargé de poils glanduleux,

¹ Porter, Rep. U. S. Geol. Surv. vi. 232 (1878).

² Watson, Bot. Cal. ii. 14 (1880).

³ Coult. Man. Rocky Mt. Reg. 320 (1885).

⁴ Rydb. Fl. Rocky Mts. 337 (1917).

brunâtres Styles 2-3. Akène trigone, non luisant, finement rugueux.—Canada—Floride: fossés; commune.” The fruit is the fruit of *P. Hydropiper*, but the “poils” are the hairs of a stranger.

Macoun's Catalogue (1883) gives no formal description, but “In ditches by roadsides, and on roads in woods eastward and apparently introduced, but westward it is found on the margins of lakes, ponds and rivers where settlement has never taken place. It is easily distinguished from the next [*P. acre* HBK.] by its triangular, black and shining *achenium*.” There is the possibility that this may be in part responsible for the opinion of some later writers as to the western nativity of *P. Hydropiper*. But most evidently the plant is *P. punctatum*. Macoun's “*P. acre*” is not described; his means of differentiation suggests that it may be *P. Hydropiper*. All the stations listed for it are in Ontario.

It is evident from this possibly tedious review that the early history of *P. Hydropiper* on the continent is inextricably mixed with that of *P. punctatum* (chiefly, no doubt, with the slender annual var. *leptostachyum*). It is also evident that as long as a given plant passed as the latter it usually was supposed to be native, but that either, taken for *P. Hydropiper*, was very likely to be thought an immigrant. From the literature and from the collections of the Gray Herbarium it appears that *P. Hydropiper* in America is less widespread than is sometimes stated; considerably less widespread, for instance, than *P. Persicaria*, of whose foreign origin there is no doubt. The latter is a weed of cultivation; *P. Hydropiper* is of barnyards, wet lands, bogs, woods, and waste places. Yet the records and material do not indicate it as occurring far from civilization. From the available evidence, it occurs chiefly east of the Mississippi and in the Pacific Northwest.

In its most typical development the American variety of *P. Hydropiper*, presently to be described, occurs in eastern Canada and the United States from the Atlantic coast to Iowa and Oklahoma. Material from the Pacific states of Washington and Oregon, and the only specimen seen from Idaho, and certain scattered specimens from the eastern portion of this continent, appear to be inseparable from the European type. What information is available as to the locality of these specimens usually indicates them as of ballast neighborhood, waste-dumps, or of places long-settled. The frequent occurrence in the Pacific Northwest of evidently native types of various plants

quite inseparable from well-known European species is rather well-known; still, the evidence available in the case of *P. Hydropiper* would rather indicate it as an introduction in that part of the country.

As to the possible identity of the American variety with any European variation of *P. Hydropiper*, it may be said that the Linnean species is indeed a variable one, and one which has been extensively subdivided by European students, but the literature indicates that these European subdivisions are based chiefly on the habit and foliage rather than the characters of the inflorescence and fruit which are to be accentuated in the present instance. Some European material at hand resembles the American in certain respects, but the latter is believed to be sufficiently divergent and widespread on this side of the Atlantic to justify its separation.

A peculiarity sometimes noted in the European species is the production of comparatively large fascicles of elongated and imperfect achenes of a similar state of development, in contrast with the usual condition in the subgenus *Persicaria*, which in the large-fascicled species usually prolong the period of development of the flowers of the fascicle. This tendency of the European material is also found in that from the Pacific Northwest, and in scattering eastern specimens otherwise referable to the European type, but is not noticeable in any material at hand which is otherwise of the American type, although the latter represents a considerably larger number of specimens. In view of the discussion of hybridism in an earlier paper,¹ the suggestion of that cause of this phenomenon may be raised, and cannot be dealt with summarily. There is also the possibility of concealed parasitism. Whatever the cause, its occurrence in material of the European type, and its absence in the American, is sufficiently striking to deserve mention.

The definite type of departure from the European characters of inflorescence and fruit as seen in the American variety seems too fundamental to have been established in the short period of European settlement of this country. It has been shown that the early records of this supposedly introduced plant are enveloped in a haze of uncertainty. Taking the situation as a whole, it seems to the present writer highly probable that the American variety of *P. Hydropiper* may represent a race of the plant whose establishment here far

¹ Stanford, *Possibilities of Hybridism as a Cause of Variation in Polygonum*. RHODORA, XXVII. 81-89 (1925).

antedates the settlement by white men and which has profited sufficiently by the advance of civilization to seize an increasingly prominent place in the American flora. For congeneric examples of a similar opportunism one need seek no further than the well-known *P. Carey* Olney and *P. pennsylvanicum* L., whose weed-tendencies entitle them to rank in that respect with most of the more assertive European additions to our flora.

The inclusive species, *Polygonum Hydropiper* may be defined as follows:

Plants annual, bright green or reddened, intensely acrid and glandular, but without glandular hairs; ocreae below usually dilated with more or less concealed diminutive panicles of cleistogamous flowers: typical panicles usually drooping: calyx green, mostly 4-parted, achene lenticular or trigonal.

The two American variations are distinguished below:

Pedicels not strongly exerted from the ocreolae: achenes mostly
3–3.5 mm. long. *P. Hydropiper*
Pedicels strongly exerted from the ocreolae: achenes 2–2.5 mm.
long. *P. Hydropiper* var. *projectum*

POLYGONUM HYDROPIPER L. Sp. Pl. 361 (1753).—Annual, whole plant peppery and acrid: stem 2–6 dm. high, erect, or assurgent, the extremities somewhat drooping, often much branched, green or brown, glabrous; internodes 3–6 cm. long; nodes not much swollen: leaves ovate or ovate-lanceolate, 1–3 cm. wide, 4–9 cm. long, sessile or decurrent on a very short petiole, acute or acuminate, often blunt at tip, cuneate or cuneate-rounded at base, glabrous or glabrescent, glandular-punctate; margin and veins nearly nude or with minute bristles; margin somewhat crisped or undulate: ocreae 0.5–1 cm. long, scarious, brown, minutely glandular-roughened, rather loose, appearing inflated below because of partly concealed panicles consisting of a few flowers only; margin truncate, with a few short bristles (about 1 mm. long): inflorescence of numerous panicles, some rudimentary and partially or wholly concealed in the ocreae, others with long slender sinuous or nodding peduncles; ocreolae and few-flowered fascicles scattered along the rhachis or sometimes rather crowded: ocreolae 2–2.5 mm. long, narrow-turbinate, herbaceous or with reddened tips, nude or with sparse bristles, rather obliquely truncate: pedicels nearly or wholly included in the ocreola, appearing shorter than the fruiting calyx: calyx green or reddish-tipped, usually 4-parted to below the middle (sometimes 3- or 5-parted), copiously dotted with dark glands; fruiting calyx 3–4.5 mm. long, 2–2.5 mm. wide, closely inclosing the entire fruit, or the style-tips barely visible: stamens 6 or fewer, appearing reduced, included: style 0.5 mm. or less, 2- or 3-parted, included or sometimes exerted in fruit: achene

2–2.5 mm. wide, 3–3.5 mm. long, dark brown, lenticular and strongly convexed on one side, flattened or somewhat gibbous on the other, or trigonal with broad angles, dull and striate with minute punctations, rather sharp-pointed.—*P. Hydropiper* of European authors; not of American (for the most part at least). *Persicaria Hydropiper* (L.) Opiz, Seznam, 72 (1852).—Widespread in Europe; in North America introduced in Newfoundland, the Magdalen Islands, Quebec, Nova Scotia and Massachusetts; also Oregon, Washington, and Idaho; chiefly in or near settlements; probably elsewhere. The following are referred here. NEWFOUNDLAND: Birchy Cove (Curling) *Fernald & Wiegand*, no. 3313. QUEBEC: Bords du ruisseau, Longueuil *Victorin*, no. 9745. NOVA SCOTIA: Canso, August 23, 1901, *J. Fowler*. MASSACHUSETTS: moist ground, West Cambridge, *Gray Herb. Local Coll.* September 29, 1894; waste heap by Horn Pond, Woburn, October 11, 1896, *E. F. Williams*. OREGON: Portland, *Suksdorf*, no. 2951; Salem, *J. C. Nelson*, no. 2480, Linnton, *Suksdorf*, no. 1567. WASHINGTON: by a spring at Prindle, Skamania County, *Suksdorf*, no. 7418; Bingen, Klickitat County, *Suksdorf*, no. 6947. IDAHO: stream-edge, Boise, *June A. Clark*, no. 294.

Var. **projectum** var. nov., foliis plerumque 1–1.5 cm. latis 4–5 cm. longis; ciliis ocrearum circa 2 mm. longis, ocreolis plerumque ciliatis; calycis fructiferis 2–2.5 mm. latis 2–2.3 mm. longis breviter ovoideis vel breviter trigonis exsertis; pedicellis gracilibus ocreolis subaequantibus; achaeniis 1.9–2.2 mm. latis 2–2.5 mm. longis trigonis vel biconvexis obtuse acuminatis nigrescentibus.—Presumably *P. Hydropiper* of the following American authors: Bigel. Fl. Bost. 93 (1814); Darlington, Fl. Cestr. ed. 3: 247 (1853); Gray, Man. 387 (1848), in part, and ed. 2: 373 (1856); Small. Monog. N. A. Polyg. 84 (1895); Britton & Brown, Ill. Fl. i. 560 (1896).¹ Wet places, borders of woods and waysides, Quebec to Wisconsin, southward to Oklahoma and Georgia; probably also in California. The following are referred here. QUEBEC: vicinity of Cap à l'Aigle, *Macoun*, no. 68,698; Little Metis, *Fowler*, August 27, 1906. MAGDELEN ISLANDS: wet clearing, Grindstone, Grindstone Island, *Fernald, Long & St. John*, no. 7371. NOVA SCOTIA: brackish shore, Sydney Mines, *Bissell & Linder*, no. 21,067; pebbly beach, Purcell's Cove, Halifax Harbor, *Howe & Lang*, no. 1504. MAINE: Rumford, *Parlin*, 1889. MASSACHUSETTS: Jamaica Plain, *Faxon*, open roadside gutters near farm barns, Worthington, *Robinson*, no. 778. RHODE ISLAND: ditches around Reservoir, Newport, *Rich*, September 21, 1901; Tiverton, *Greenman*, no. 1751. NEW YORK: low ground, Ithaca, *Metcalf*, no. 2238. VIRGINIA: near Franklin, *Heller*, no. 1125. WEST VIRGINIA: moist pebble shore, banks of Shaver's Fork, Parsons, Tucker Co. *A. H. Moore*, no. 2806 (TYPE in Gray Herb.). MICHIGAN: along a swamp road,

¹ Not *P. Hydropiper* Michx. Fl. Bor.-Am. i. 239 (1803); Darlington, Fl. Cestr. 48 (1826) and ed. 2: 247 (1837); Porter in Rothrock, Cat. Pl. Nev. etc. 231 (1878); Macoun, Cat. Can. Pl. i. 441 (1883); all of which are *P. punctatum* Ell.

Turin, Marquette Co., *B. Barlow*, August 10, 1901. WISCONSIN: Milwaukee, *Lapham*. ILLINOIS: rock barrens, Wakanda, *Gleason*, June 12, 1903; moist soil, Skokie Marsh, W. of Glencoe, *Sherff*, September 3, 1911. IOWA: Ames, *Pammel, Bell & Combs*, no. 197. OKLAHOMA: moist creek-bank near Shawneetown, McCurtain Co., *Houghton*, no. 3881 (distributed as *P. hydropiperoides*); by R. R. track near Howe, Leflore Co., *Stevens*, no. 27,981. The following is referred here as a somewhat exaggerated type, unique in the collections at hand, not resembling material from Oregon and Washington, which is referable to typical *P. Hydropiper*. CALIFORNIA: moist places in fields in the blue oak belt, 5 mi. so. of Redding, plentiful, *Heller*, no. 12,445 (distributed as *Persicaria punctata*).

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EFFECTS OF THE POST-PLEISTOCENE MARINE SUBMERGENCE IN EASTERN NORTH AMERICA.

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(Continued from p. 72.)

THE POST-PLEISTOCENE SEA IN RELATION TO THE INTERIOR DISTRIBUTION OF MARITIME PLANTS IN EUROPE.

Oceanic submergences in Europe corresponding to the Champlain submergence have been carefully studied, and with these submergences has been correlated the distribution of living plants and plant remains found in the post-glacial and inter-glacial deposits. Most of this work has been done in Scandinavia,¹ by the coöperation of geologists and botanists.

Miss Warburg² describes plants of the seashore which survive in the interior of Sweden, probably due to the fact that the sea formerly reached these places. The Mälaren [a lake near Stockholm] was once a bay of the Baltic Sea, and upon its shores still survive plants of the sea coast, such as *Triglochin maritima* and *Juncus Gerardi*. From her I quote as follows: "Besides the plants already mentioned Sernander gives still another example of this kind of relic in the flora

¹ For a survey of Pleistocene and Post-Pleistocene changes of level in Scandinavia, and a brief review of successive plant immigrations see W. F. Wright: *The Quaternary Ice Age*. 1914.

² Warburg, Elsa. *On Relics in the Swedish Flora*. Geol. Soc. Upsala Bull. 8: 146-170. 1908.